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ABSTRACT

First graders (105 males and 152 females) from 16 "Central City" schools within the Catholic Archdiocese of Los Angeles were selected because they were diagnosed as poorly prepared for regular classroom activities. Following the administration of a six-category test battery, the children were placed within two groups: Group 1, containing 84 children, was exposed during the first half of the school year to one-half hour daily enrichment classes composed of learning games intended to improve the academic operations previously evaluated; Group 2, with 73 children, remained within their regular classroom environment during the first half of the year. Following a second testing using the six-category battery, the children in Group 2 were exposed to the daily program of Learning Game enrichment, while Group 1 remained in their classrooms. The Learning Games, in general, are activities which require an active response on the part of the child. The content of the enrichment program was unique to each school and flexible. Analysis of the data involved intra-group correlations of the test scores, inter-group comparisons of rates of change, and other similar procedures. (Author/JM)

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THE EFFECTS OF A PROGRAM OF LEARNING GAMES UPON SELECTED ACADEMIC ABILITIES IN CHILDREN WITH LEARNING DIFFICULTIES

1970-1971

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CHAPTER I

INTRODUCTION

The use of games to instill academic concepts and operations has a long history. For example, Plato has been quoted as suggesting that, "In teaching young children, train them by a kind of game and you will be able to see more clearly the natural bent of each." (12) In the intervening centuries, others began to explore the manner in which active games might contribute to educational processes. In the late 1600's, Fenelon is reported to have said that he had observed certain children who learned to read while playing (20). While, at the beginning of the 20th century, Maria Montessori's writings contain references to learning mathematics through active games and to the importance of big muscle activities in the acquisition of academic concepts.[1]

However, scientific research exploring the efficiency of an active game approach within the educational curriculum

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[1]She further stated that she did not know all the ways in which big muscle activities might be employed in the betterment of intellectual abilities. In one of her writings, however, she describes an egg-crate game in which 12 children line up in two rows of six, like eggs, and then separate into two equal groups, half-a-dozen, then into 4 equal groups, which were then counted, illustrating division, etc.

has had a relatively brief history. Moreover, many of the available studies are exploratory rather than definitive in nature. Since the early 1960's, James Humphrey and his students have been the most active scholars within this problem area (13)(14)(15)(16). Additionally, studies by Cratty and his colleagues have also been conducted since 1966 (8)(5).

Many of the currently available studies moreover, suffer from inadequate controls, too few subjects, or other methodological or practical limitations. Several of these short-comings are not always the fault of the investigators; at times, school district personnel seem reluctant to "trust" an entire block of learning experiences to an individual who will confront the children with pleasurable game activities; while other administrators have had difficulty perceiving the usefulness of control groups implanted within the studies, and thus the investigator cannot always adequately control for the various extraneous variables which are likely to contaminate the final results obtained.

Despite the limitations of the available data, the educational outcomes realized when exposing children with low learning potential to active game experiences have often been impressive. For example, in previous research, Cratty and Martin (5) found that the games approach resulted in significant improvement in letter recognition, the

identification of letter sounds, the naming of geometric figures, letter identification, and in several kinds of serial memory tasks. In this study carried out during the 1969-70 school year, for example, it was found that similar children, taught within the confines of a classroom, evidenced less improvement than those exposed to active learning games. (5)

This program of research, similar to that by Humphrey and his students, as well as those instituted by Ross (21) and others (14), attempts to match program objectives (academic improvement) with program content in rather specific ways. It has not been attempted, as sometimes has been true when other "movement-oriented" approaches have been employed, to "stretch" the "transfer width" from such program content as locomotor behaviors, patterning and balancing activities to objectives which include reading, mathematics and similar academic operations.

Careful observation of the children participating in previous years within the program similar to that described in this monograph, as well as a thorough survey of the literature on this topic, leads to the conclusion that there are at least three primary reasons for the positive results obtained by the various investigators. These reasons include:

(a) Heightened motivation is achieved: These games are fun, success in them is reinforcing, children like to participate, and work gladly and happily, as contrasted

to their less effusive behaviors within more traditional academic confines.

(b) Differences in activity needs are accommodated to: Naturally active children are confronted with educational strategies compatible to their activity needs and behavioral tendencies. They need not strain to "remain still" and to otherwise restrict their natural tendencies toward movement when exposed to the active games approach.

(c) Attention is focused: There is a wide variety of scientific literature which suggests that the quality of the child's attention to a task is more important than the number of times (or the amount of time) he is exposed to a given learning task.

It appears virtually impossible for a child to be engaged, for example, in calling out letters as he hops in them on a grid, and at the same time to direct his attention elsewhere on activities extraneous to the problem of letter identification. The learner appears to be totally engaged in the task at hand, under the conditions described, as he must move his body, call out the letters, and watch where his feet land. Doing anything else or apparently thinking about anything else seems to be a virtual impossibility.

The results of these previous investigations, together with the success subjectively perceived by observing teachers and principals prompted the extension of a previous program (5) carried out during the 1970-71 school year.

Purpose:

The purpose of this program was to determine the effects of an enrichment program of active learning games upon selected pre-reading abilities of selected first grade children with learning difficulties. The abilities focused upon included letter and pattern identification, self-control, and short-term serial memory.

Analysis of the data emerging from this study should lead toward answers to several pertinent sub-problems.

1. What specific abilities are positively and significantly influenced by exposing children to learning games?

2. Are there significant individual differences in improvement as a result of exposure to active learning games incorporating pre-reading skills and concepts?

3. During what time in the school year is exposure to "active enrichment" likely to have the most positive effects upon the behaviors under consideration?

Definition of Terms

Total Body Movement:

Total body movement involves movement of the total body through space via locomotor activity, so that the body's center of mass changes its location in a horizontal and/or vertical plane. The bodily movements used in most of the games within this program include hopping, running ,skipping and the like.

Learning Games:

The games to be used in this program are described in several texts, some written by the primary investigator (4)(3) and others by other authors (12)(13). Some of the games incorporate academic operations in rather direct ways, such as hopping on a grid containing letters, while spelling. Others are more indirect in nature, such as serial memory tasks, which require the observation and the immediate reproduction of movements in correct order.

Hypothesis:

It was hypothesized that an enrichment program of active learning games for children identified as evidencing low academic potential would significantly raise scores in tests evaluating selected abilities, when contrasted to children who are not exposed to this type of enrichment.

Moreover,it was assumed that termination of a program of active game enrichment would result in significant diminution of the abilities assessed.

Rationale:

1. Activities involving total body movement are fun for children. Motivating experiences elicit learning improvement.

2. Movement activities will aid academic operations to the extent to which the academic operations are incorporated into the motor activities in direct and obvious ways.

3. Vigorous games in which the total body is involved elicit better attention on the part of children who are both difficult to educate and who evidence low academic potential than will the same academic operations presented within the more traditional classroom environment.

4. Children learn in a variety of ways; total body movement represents another learning strategy which, when combined with other approaches or used alone, may represent a helpful way to aid some children to acquire some academic skills more easily.

SUMMARY AND OVERVIEW

Chapter 2 contains the methods and procedures employed during the year. The chapter which follows contains the results and findings obtained as the result of analysis of data from three testing periods at the beginning, middle, and end of the school year, while the final chapter contains a summary, conclusions, and implications of the findings, further studies, and practical implications for the implementation of educational programs.

CHAPTER II

METHODS AND PROCEDURES

AN OVERVIEW

The program concentrated upon children entering the first grade in 16 "Central City" schools within the Catholic Archdiocese of Los Angeles. During the first semester, twelve "low potential" children were identified within each school and, using active learning games, six were given one-half hour a day (five days a week) of special practice in acquiring selected letter concepts and academic operations. The remaining six in each school remained in classrooms, serving as controls during the first semester.

At the completion of one semester the scores of the two groups were contrasted to each other and to scores collected prior to instituting the program. Thus, at the end of the first semester, the following comparisions were carried out:

1. Comparison of the initial scores achieved by the controls (Group I) to those who remained in their regular classes all day (Group II).

2. Comparison of the scores, after one semester's work by the children exposed to learning games, by test, to scores obtained at the beginning of the year. The same scores by children remaining in the classroom are also contrasted.

3. Comparison of improvement made by children exposed to learning games, as compared to the improvement evidenced by the classroom controls.

4. Comparison of improvement by lowest achieving children in Group I and Group II, and by children scoring between 70 and 80 in the I.Q. test employed.

During the second semester, the children initially exposed to learning games remained in their classrooms, and the second group of six in each school received special tutoring in selected operations and concepts using learning games. Thus, at the end of the second semester, the following additional comparisons were possible:

1. The illustration of any plateauing effects seen during the second semester in the scores of the children who were exposed the first semester to learning games, after they returned to the classroom the second semester.

2. Comparison of final scores of children who received active game enrichment the first semester, versus the scores of the children who were exposed to active games the second semester.

3. Retention of attributes evidenced by first group to receive learning games, after one semester, which involved no special enrichment.

4. Possible acceleration of the acquisition of selected concepts and operations by children exposed during the second semester to the learning games.

The Subject Population:

The subject population was selected from 16 elementary schools within the "Central City" schools of the Catholic Archdiocese (a total of 17 first grade classes). The 12 first grade children in each class scoring lowest in the Metropolitan Reading Readiness Test were tested employing six tests specifically designed for the project. (see Appendix)

204 children were selected in this manner. During the school year 27 of these children either moved from the district, or attended school so seldom that valid and complete measures could not be obtained from them. Thus, scores from a total of 157 children were employed in the final analyses (84 in Group I, and 73 in Group II).

Ten of the classes contained Negro children (120) while the remaining seven contained children (84) generally of Mexican-American ancestry. The median income of the families from which these children come, as nearly as can be estimated, is from $3,000 to $5,000 per year. In addition to the test scores mentioned in the previous paragraphs, the children were given the SRA's test of educational ability during the first testing period at the beginning of the school year, from which an IQ score may be computed.

Tests Administered:

At three times during the school year, a battery of six tests designed for this investigation was administered to all the children-subjects. The first administration

occurred prior to the beginning of the program, during the week October 1-15; the second, between semesters, from February 1-15; and the final administration, following the completion of the program,from June 1-11th.

The children were tested individually, in distraction-free rooms by testers who were not their regular "learning game" teachers. The tests were given in random order, and each child spent from 20-30 minutes with the tester at each testing session. The tests included:[2]

Pattern Recognition: Each child was shown a card containing one of five common geometric patterns (circle, square, triangle, rectangle, half-circle) and asked, one at a time, to verbally identify each one ("Tell me what shape you see on each card"). If no correct response was elicited within three seconds, the tester passed to the next card. Highest possible score was five, for correct identification of all figures shown.

Letter Recognition (verbal response): 26 cards containing upper-case letters of the alphabet, in random order, were exposed one at a time, and the child was asked to, "Say what letter I am showing to you." Letters were shown at 3 second intervals, and if no response was elicited during this time, another letter was exposed. Total possible score was 26.

Letter Recognition (written response): The child was given paper and pencil and shown, in random order, one at

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[2]See appendix for specific content

a time, lower-case letters. After each exposure lasting five seconds, the card was turned so the child could no longer see the letter and was instructed to "Write down the letter you see, after I put the card down." The child was given five seconds to begin writing down his response to each letter presented visually. Total possible score was 26 correct responses.

Impulse Control: A 12' long line made of 1" wide yellow tape was placed on the floor, and each child was asked, when standing at one end, to "Walk the line to the end as slowly as you can. Do not stop walking once you have begun." A score was recorded to the nearest second, using a stopwatch.

Serial Memory, Auditory Memory for Letters: Groups of letters were read, one at a time, to the children and they were asked to repeat each set just as it was given to them. Initially the child was read one letter, then two, then a set of three, etc., until he was unable to repeat correctly two consecutive sets of letters. Letters were read to the child at the rate of one-second per letter. The score was the number of sets of letters repeated correctly, maximum of 8 sets possible.

Serial Memory, Visual Memory of Letters: Sets of cards with the cards containing 2,3,4, etc., upper-case letters were exposed, one set at a time for a period of 20 seconds, to each child. After observing each set, letters were

removed from view, sorted, and handed back to the child, taking about four seconds for this process. The child was then asked to arrange them in the order in which they were originally shown to him. Score achieved was the number of sets correctly ordered by the child, maximum of 6 sets.

Reliability and Validity: The tests employed in this battery have been found to be reasonably reliable in previous investigations. For example, both written and verbal letter recognition tests were found to be reliable on an inter-trial basis (.98 and .93 respectively). (8) Similarly, the pattern recognition test (verbal response) was found significant (test re-test r=.89) in previous studies. Tests of serial memory were also reasonably reliable in previous studies (.79 and above), based upon test re-test correlations.

The self-control score was also found to be reliable in the study finished last year (.80), based again on test re-test comparisions.(5)

While the tests contain a certain amount of "face validity", i.e. identification of letters verbally and in written form does indeed evaluate the ability to identify letters within those parameters, one might question whether (a) the tests in the battery evaluate a general memory quality, or does the impulse control test evaluate some kind of general self-control attribute, and (b) what is the predictive value of the tests, for learning potential, future reading success, and similar, later to be achieved academic

goals and operations.

Although a discourse on these questions could occupy a monograph several times the size of this one, in general it has been found that there are moderate positive relationships between various measures of serial memory, independent of the stimuli to be remembered when children of the primary grades are evaluated. (5) A common variance of from 30-40% is usually obtained (based upon r^2). Cawley and others have found that the identification of letters, and particularly the translation of letter shapes into their corresponding sounds is highly predictive of later reading success. (2) While in previous studies we have carried out, as well as in investigations by Maccoby and others, it has been found that measures of self-control similar to that employed in this study are moderately predictive of I.Q. scores and academic ability. (5)(21) The interested reader might wish to peruse these publications in order to obtain deeper insight into the questions of validity which are treated superficially within these paragraphs.

PROCEDURES, TIME SCHEDULE

During the initial month, October 1-October 15, 1970, the instructors were trained, and testing procedures finalized and rehearsed. Also during this period, the children in all 16 classes were tested.

The remainder of the first semester, October 15 to

approximately February 15, the first experimental group (102 children) engaged in the special enrichment classes daily, for one-half hour.

At the beginning of the second semester (spring 1971), the children in both groups were re-tested, using the same battery of tests given at the beginning of the program. Then the group initially assigned to the regular classroom schedule (Group I) was given learning games emphasizing pre-reading concepts and operations, while the experimental group remained in the classroom (Group II). At the completion of the second semester, all children in both groups were again re-tested.

The design as described, it is believed, made the best use of the available subjects. All children received some direct benefit from the learning games, as required by the Archdiocese, and at the same time, reasonably adequate control procedures were carried out. Similarly, the procedures outlined permitted carrying out a sub-study involving retention by comparing the progress of the children initially exposed to the active games program (Group I) after a second semester during which no special enrichment was forthcoming.

More elaborate control procedures were employed during the 1969-70 school year (5), and it is believed that the procedures outlined above were adequate for the type of program described on these pages. 24

Analysis of the Data: Mean scores and standard deviations, by test, group, and for selected sub-groups (lowest achieving 6 children in each group by test) were computed using BMD Library Program 07D within the Health Sciences Computer Facilities at UCLA. Additionally, comparisons were computed illustrating inter-group and intra-group changes in means which occurred throughout the school year. Correlation matrices were also computed using the same program, contrasting test scores obtained during the same testing period, for the total subjects, and by sub-group, as well as test comparisons spanning testing periods. Additional computations, primarily "t" scores,were computed using an Olivetti-Underwood's Programma 101, located within the Perceptual-Motor Learning Laboratory at UCLA.

Program Content: Several types of activities were employed in the program, most of which have been outlined in previous publications by the author. (4)(3)

Essentially, the games combined active vigorous responses by the children,with familiar academic operations. Instead of, as would be found within a usual classroom, a child merely raising his hand and/or responding verbally when he knows a letter placed on a blackboard, the child in this program is required to run and to find the correct letter from among a pile of letters, or to jump into a square within a grid containing all the letters of the alphabet.

In addition to hopping and jumping and similar locomotor activities, throwing behaviors were also utilized in some of the games. For example, a child was sometimes asked to throw a bean bag into the proper geometric shape among several placed on a blackboard.

Additionally, relaxation training was employed, together with impulse control activities in an effort to "calm down" the more hyperactive youngsters. Relaxation involves aiding children to perceive residual muscular tension within their bodies, by asking them to tighten their total bodies and selected muscle groups to varying degrees, using whatever language which is likely to elicit the appropriate imagery on the part of the child. Various impulse control activities usually involve requiring a child or children in competition with each other, to see how slowly they can move in various ways, i.e. line drawing, getting up and down, etc.

The serial memory activities involved usually required a child to copy an increasing number of movements previously made by another child. But as was the case in other types of games within the program, no exact prescriptions were written for the "enrichment teachers." Rather they were free to select from a number of appropriate alternatives, while at the same time cautioned not to teach toward the specific measures contained in the test battery employed.

Moreover, the special teachers assigned to the program of "active enrichment" were required to schedule conferences with the regular classroom teachers, so that individual needs could be met, and the two programs would be made to move in the same directions, with similar goals, methods, and objectives. Thus, each school contained an enrichment program with slightly different content, in which teachers were encouraged to explore alternative strategies, and which coincided with goals and directions of sixteen different classroom teachers.

SUMMARY

Over two hundred children from 16 first grade classrooms were selected to participate in an enrichment program composed of active learning games. One-half of the group (Group I) received this kind of special attention, one-half hour daily, for the first half of the year, while the second half (Group II) began during the second half of the school year; then the first group returned to their regular academic program during this second half of the year. All children received regular classroom instruction during the entire year, while many received individual tutoring from other special government supported programs.

Inter-group comparisons were carried out to determine the effects of the special treatment, by group, and by subgroup (lowest scoring children in each group). Correlation coefficients reflecting intra-group consistence, inter-test

specificity, and inter- and intra-test consistency over time, were also computed.

The program content incorporated activities which attempted to pair active vigorous movement with academic operations, to encourage short-term memory, and to aid the children to exhibit better self-control.

CHAPTER III

RESULTS AND FINDINGS

Overview: The findings and results have been organized in the following manner. Initially, a survey of the nature of the general subject population is presented, together with selected survey statistics by group, based upon the scores they achieved on the various tests administered. Within this first section, also, the nature of the test battery administered is examined employing correlation matrices which were obtained when all scores were contrasted at each of the three testing periods.

The second section contains various inter-group comparisions obtained at the three testing periods. Additionally selected intra-group scores are compared, indicating changes which were recorded by each of the two groups as they progressed through the school year.

The third part contains selected analyses of the scores obtained from individual children, as well as the nature of the scores obtained from selected groups of children. Two additional analyses are contained in this final part of the chapter: (a) data exploring how the lowest scoring children in each group, based upon their initial scores in each of the six tests, fared during the school year. This

analysis was carried out by examining their progress, or lack of it, as seen in scores achieved during the final two testing periods. The second analysis examined changes in mean scores throughout the school year (by test) by children scoring 80 and below in the I.Q. test administered during the initial testing period.

The chapter concludes with a summary of the findings, together with a brief interpretive discussion. The chapter which follows, Chapter IV, contains a more detailed exploration of the results, a summary of the investigation, together with conclusions, and both theoretical as well as practical implications toward which the findings seem to point.

A SURVEY OF THE SUBJECT POPULATION AND GENERAL CHARACTERISTICS OF SUB-GROUPS STUDIES

Subject Population: Overall, 157 subjects were involved in the final tabulations; eighty-four (84) in the group initially exposed to the experimental program during the first half of the year (and hereafter referred to as Group I), and seventy-three (73) in the group serving as classroom controls during the first half of the semester and then exposed to the experimental "movement-oriented enrichment" during the latter half of the school year (labeled Group II).

The sexes' ratios were highly similar (F=.0009) within each group, with approximately one-third of each group comprised of girls, while the remaining two-thirds were

boys. (Table I)

TABLE I

	Males	Females
Group I	56	28
Group II	49	24
Total	105	52

The mean age of the total subject population was 77.72 months (SD 4.69) or 6.5 years, at the time of the first testing during the beginning of their first grade year. Similar to the sex comparison, when the mean ages are compared by group, there were no significant differences. (t = .589) as can be seen in Table II.

TABLE II

Age in Months and Years

Group I	77.99 months (SD 4.72)	6.5 years
Group II	77.41 months (SD 4.67)	6.45 years

Intellectually, the groups were also highly similar. The mean I.Q. for the total subject population was 97.36 (SD 10.25) while upon contrasting the I.Q.'s of the sub-groups there were no significant differences found (Table III) (t = 1.58). There were also no significant inter-group

differences in mental age (t = .626)

TABLE III

Group Comparisons of Mental Age and I.Q.

	Mental Age		I.Q.	
	M	SD	M	SD
Group I	75.07	7.12	96.40	10.20
Group II	75.92	6.01	98.47	10.28

Scores of the Total Population Obtained Throughout the School Year, by Test.

As would be expected, improvement in the tests administered was recorded for the total subject population (N=157), when data from the 1st, 2nd, and 3rd testing periods were contrasted. These changes in the mean scores in six tests may be inspected on Table IV, and seen graphically on Figure I, A-F.

As can be seen, the most marked improvement (Figure I-D) overall, was in the impulse control scores; and as will be seen when inter-group comparisons are examined, most of this occurred as a result of specific relaxation and impulse control training on the part of both groups when they were exposed to such training.

Improvement from 1st to 2nd testing was highly significant (t = 3.40, p.01) as was improvement from the 2nd to the final testing (t = 2.40) significant at the

FIGURE I - A. MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR PATTERN RECOGNITION, FOR EACH OF THE THREE TESTING PERIODS

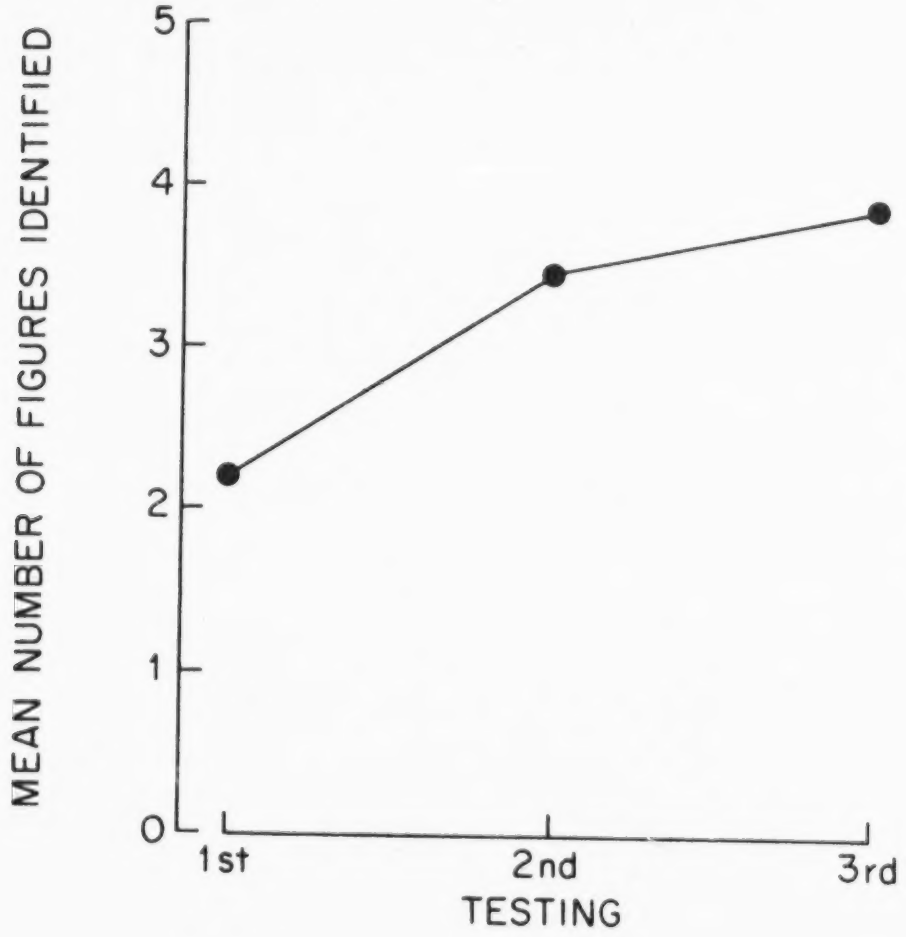


FIGURE I - B. MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR LETTER RECOGNITION (VERBAL), FOR EACH OF THE THREE TESTING PERIODS

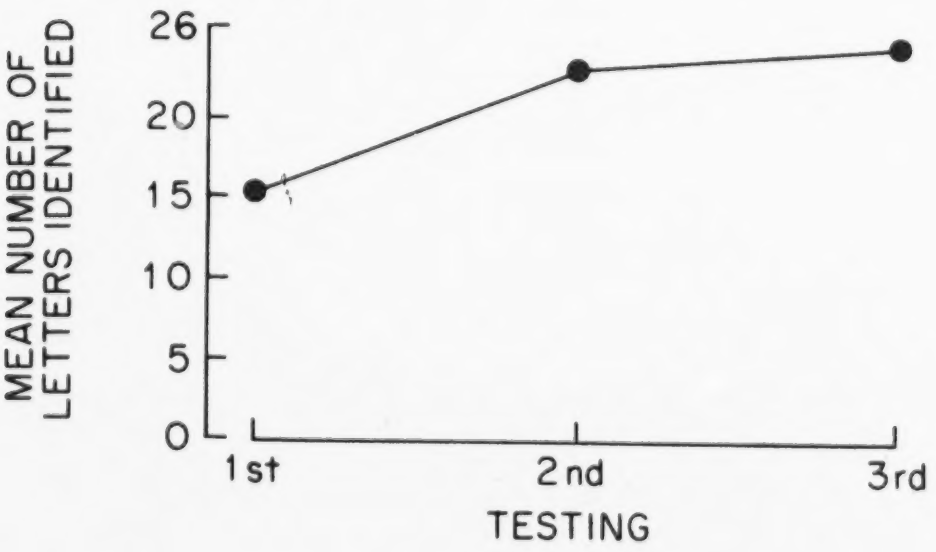


FIGURE 1 - C. MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR LETTER RECOGNITION (WRITTEN), FOR EACH OF THE THREE TESTING PERIODS

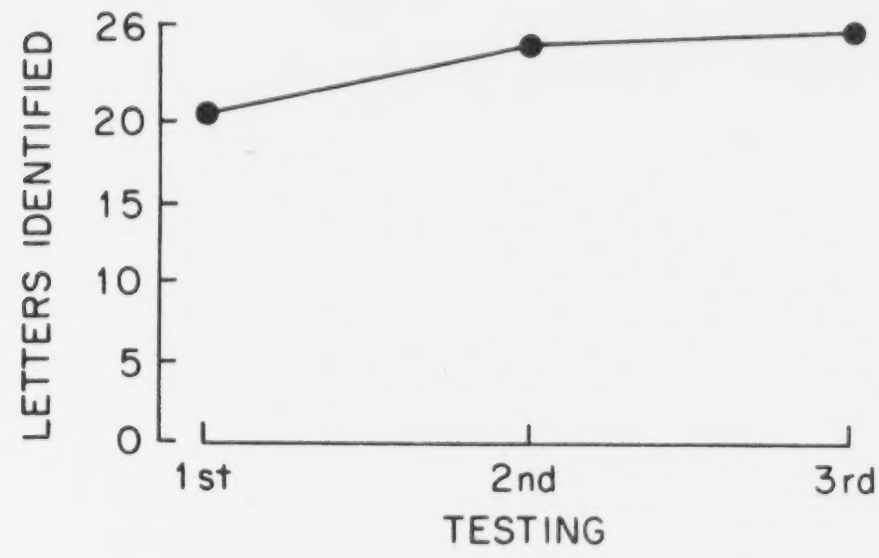


FIGURE 1 - D. MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR IMPULSE CONTROL, FOR EACH OF THE THREE TESTING PERIODS

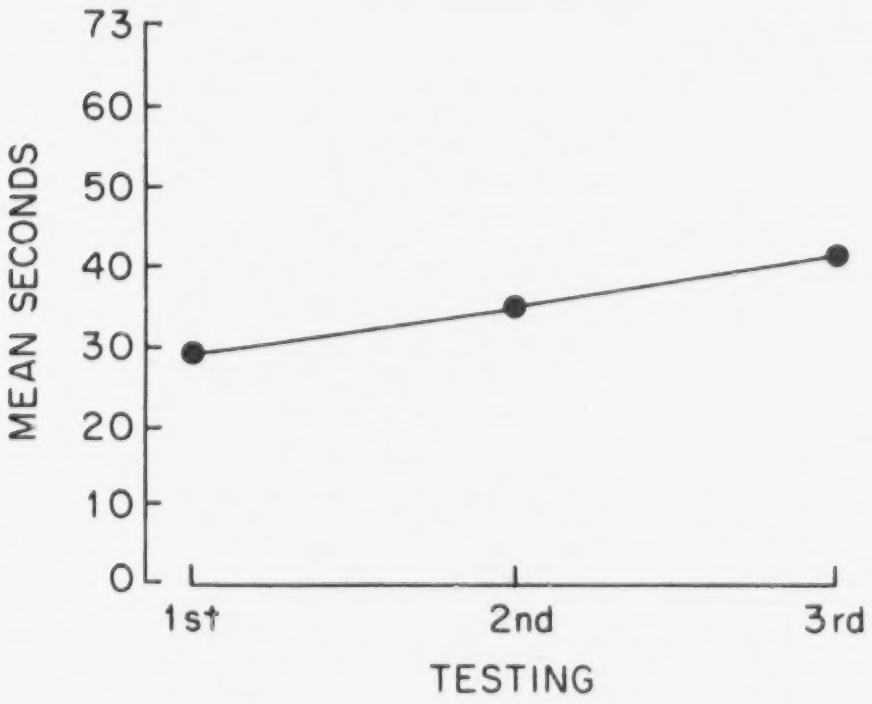


FIGURE I - E. MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR SERIAL MEMORY (AUDITORY), FOR EACH OF THE THREE TESTING PERIODS.

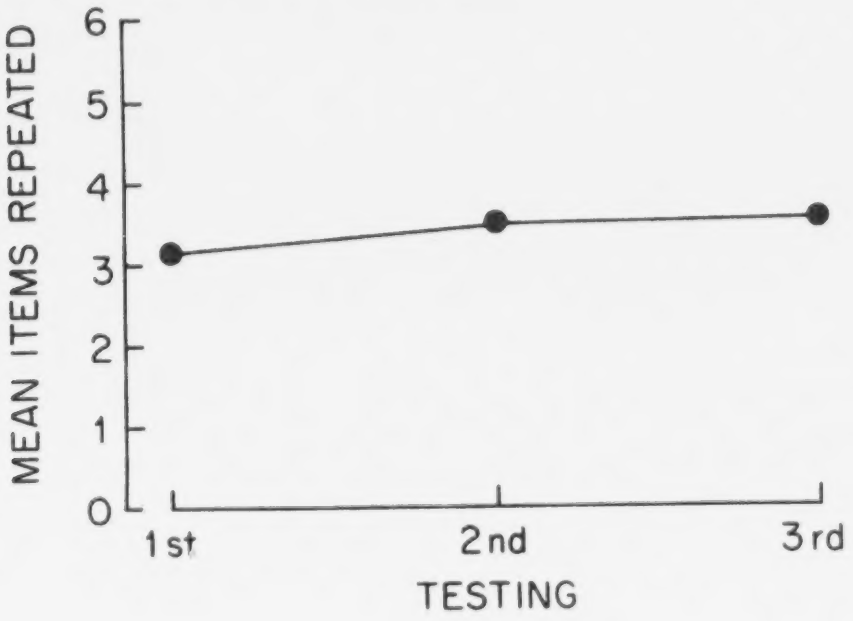
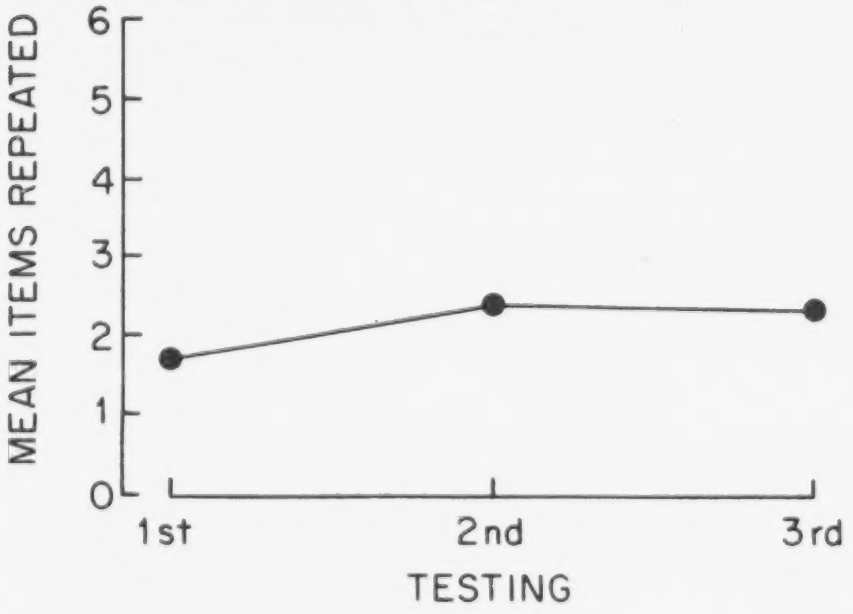


FIGURE I - F. MEANSCORES FOR THE TOTAL SUBJECT POPULATION (N=157) FOR SERIAL MEMORY (WRITTEN), FOR EACH OF THE THREE TESTING PERIODS



.01 level also.

Most marked improvement in both measures of letter recognition was recorded during the first semester, on the part of both groups (Figures I-B and I-C) thus reflecting the combined efforts of the teachers in the enrichment program, as well as those in the classroom as they concentrated upon this important part of the first grade curriculum. However, improvement from Test I to Test II in both measures of letter recognition was statistically significant, as were changes in both mean scores when the results of the 2nd and 3rd testing were compared.[3]

Steady improvement throughout the semester was recorded in the measures of pattern recognition obtained (Figure I-A). Although initial improvement (1st to 2nd testing) was greater, ($t = 9.05$) improvement recorded from the 2nd to 3rd was also significant at the 1% level ($t = 3.13$). While also in the measure of serial memory for items presented visually, improvement was most marked during the first semester (Figure I-F), and all improvements found were statistically significant while the scores in auditory serial memory to

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[3]"t" value between 1st and 2nd testing for letter recognition (verbal) was 12.61, and between 2nd and 3rd in the same measure was 7.65, both of which were significant at the 1% level. The "t" values for the same two measures, using the test of letter recognition(written) were 10.77, and 5.30 respectively, also reflecting significant changes at each testing period which reached the 1% level of confidence.

items presented verbally (serial memory, auditory) remained relatively constant, from the first to the final testing period as shown on Figure I-E, although a significant change was found when the means of the 1st and 2nd testing periods were contrasted ($t = 3.60$, p. 01).

SELECTED CORRELATIONS, BETWEEN THE TESTS ADMINISTERED

Further insight concerning the nature of the tests administered may be obtained upon inspection of correlation matrices obtained when the scores obtained during the first and subsequent testing periods were compared to each other. (Table V,A-C)

In general, it may be seen in Table V that the tests apparently were measuring highly specific qualities. Although correlations, based upon the scores of 157 subjects, which exceeded .159 are significant at the 5% level, while those higher than .208 are significant at the 1% level, seldom do the absolute sizes of the correlations indicate anything but slight positive relationships. Even the scores obtained from the two letter recognition tests (written versus verbal response) evidence a positive correlation of only +.35 (Table V-A), while the only other comparison evidencing a positive correlation of as high as +.30,was on the second testing when the scores reflecting the verbal identification of geometric patterns, and that evaluating the verbal recognition of letters were contrasted. (Table V-B) In all other comparisons, the correlations were lower than these.

TABLE IV

MEAN SCORES FOR THE TOTAL SUBJECT POPULATION (N=157) BY TEST, FOR EACH OF THE THREE TESTING PERIODS CONDUCTED THROUGHOUT THE SCHOOL YEAR.

	1st testing		2nd testing		3rd testing	
	M	SD	M	SD	M	SD
1. PATTERN RECOGNITION (Max. 5.0)	2.20	1.31	3.44	1.33	3.86	1.08
2. LETTER RECOGNITION (VERBAL) (Max. 26.0)	15.27	7.96	23.14	1.33	24.93	2.76
3. LETTER RECOGNITION (WRITTEN) (Max. 26.0)	20.43	5.26	24.78	2.00	25.58	.88
4. IMPULSE CONTROL (secs.)	29.06	14.60	35.41	21.50	40.94	25.19
5. SERIAL MEMORY (AUDITORY) (Max. 6.0)	3.11	.80	3.47	.98	3.56	.85
6. SERIAL MEMORY (VISUAL) (Max. 6.0)	1.78	.91	2.40	1.07	2.39	1.10

TABLE V

INTERCORRELATIONS OF SCORES OBTAINED FROM TOTAL SUBJECTS AT EACH OF THE TESTING PERIODS (N=157)

A. FIRST TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.373+	1.000				
3. Letter Recog. (written)	.235+	.353+	1.000			
4. Impulse Control	.049	.137	.204+	1.000		
5. Serial Memory (auditory)	.290+	.216+	.230+	-.013	1.000	
6. Serial Memory (visual)	.113	.246+	.074	.225+	.095	1.000

B. SECOND TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.309+	1.000				
3. Letter Recog. (written)	.068	.130	1.000			
4. Impulse Control	.080	.026	.030	1.000		
5. Serial Memory (auditory)	.246+	.179++	.129	-.129	1.000	
6. Serial Memory (visual)	-.046	.193++	.090	.133	.157	1.000

C. THIRD TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.173+	1.000				
3. Letter Recog. (written)	.133	.041	1.000			
4. Impulse Control	.064	.032	.124	1.000		
5. Serial Memory (auditory)	.176+	.063	.052	.033	1.000	
6. Serial Memory (visual)	-.002	.142	.163+	.128	.101	1.000

+ significant at 1% level
++ significant at 5% level

TABLE VI

INTERCORRELATIONS OF SCORES OBTAINED FROM GROUP I (N=84) AT EACH TESTING PERIOD

A. FIRST TESTING PERIOD	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.308+	1.000				
3. Letter Recog. (written)	.165	.323+	1.000			
4. Impulse Control	.061	.193	.208	1.000		
5. Serial Memory (auditory)	.354+	.161	.354	-.013	1.000	
6. Serial Memory (visual)	.054	.199	.060	.189	.049	1.000

B. SECOND TESTING PERIOD	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.205	1.000				
3. Letter Recog. (written)	.060	.165	1.000			
4. Impulse Control	-.232	-.114	.061	1.000		
5. Serial Memory (auditory)	.228++	.131	.054	-.219	1.000	
6. Serial Memory (visual)	-.239	.143	.104	.202	.157	1.000

C. THIRD TESTING PERIOD	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.170	1.000				
3. Letter Recog. (written)	.226++	-.087	1.000			
4. Impulse Control	-.154	-.094	.124	1.000		
5. Serial Memory (auditory)	.234++	.102	.073	.079	1.000	
6. Serial Memory (visual)	-.121	.080	.107	.245++	.116	1.000

\+ significant at 1% level
++ significant at 5% level

TABLE VII

INTERCORRELATIONS OF SCORES OBTAINED FROM GROUP II (N=73)
AT EACH TESTING PERIOD

A. FIRST TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.445+	1.000				
3. Letter Recog. (written)	.321+	.397+	1.000			
4. Impulse Control	.032	.058	.206	1.000		
5. Serial Memory (auditory)	.214	.292++	.070	-.012	1.000	
6. Serial Memory (visual)	.187	.310+	.074	.282++	.149	1.000

B. SECOND TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal	.262++	1.000				
3. Letter Recog. (written)	.178	.135	1.000			
4. Impulse Control	.058	-.092	.025	1.000		
5. Serial Memory (auditory)	.302+	.223	.257++	-.004	1.000	
6. Serial Memory (visual)	.100	.113	.072	.013	.158	1.000

C. THIRD TESTING PERIOD

	1	2	3	4	5	6
1. Pattern Recog.	1.000					
2. Letter Recog. (verbal)	.181	1.000				
3. Letter Recog. (written)	-.006	.192	1.000			
4. Impulse Control	.223	.125	.119	1.000		
5. Serial Memory (auditory)	.113	.016	.033	.018	1.000	
6. Serial Memory (visual)	.061	.221	.204	-.010	.139	1.000

+ significant at 1% level
++ significant at 5% level

TABLE VIII

INTERCORRELATIONS OF SCORES OBTAINED FROM TOTAL SUBJECTS' SCORES (N=157) AT FIRST TESTING, AS CONTRASTED TO THE SCORES OBTAINED AT THE SECOND AND THIRD TESTINGS.

A. SCORES AT FIRST TESTING CONTRASTED TO SCORES AT SECOND TESTING

		First Testing					
		1	2	3	4	5	6
Second Testing	1. Pattern Recog.	.356+	.189++	.136	.108	.105	.086
	2. Letter Recog. (verbal)	.317+	.567+	.300+	.066	.204++	.163++
	3. Letter Recog. (written)	.066	.132	.200++	.220+	.096	.166++
	4. Impulse Control	.059	-.038	-.004	.366	-.145	-.041
	5. Serial Memory (auditory)	.261+	.244	.131	.144	.498+	.100
	6. Serial Memory (visual)	-.21	.144	.45+	.175++	.025	.300+

B. SCORES AT SECOND TESTING CONTRASTED TO SCORES AT THIRD TESTING

		Third Testing					
		1	2	3	4	5	6
Second Testing	1. Pattern Recog.	.309+	.165++	-.076	-.035	.177	-.239
	2. Letter Recog. (verbal)	.193++	.710+	.131	.071	.122	.175++
	3. Letter Recog. (written)	.051	.070	.129	.173++	.131	.025
	4. Impulse Control	-.113	-.083	-.020	.150	.071	-.010
	5. Serial Memory (auditory)	.207++	.048	.075	.137	.556+	.126
	6. Serial Memory (visual)	-.068	.100	.148	.022	.073	.256+

C. SCORES AT FIRST TESTING CONTRASTED TO SCORES AT THIRD TESTING

		First Testing					
		1	2	3	4	5	6
Third Testing	1. Pattern Recog.	.406+	.229+	.152	.070	.255+	.183++
	2. Letter Recog. (verbal)	.187++	.337+	.205++	.012	.117	.170++
	3. Letter Recog. (written)	.091	.267+	.226+	.032	.130	.099
	4. Impulse Control	-.108	.119	.088	.230+	-.033	.142
	5. Serial Memory (auditory)	.246+	.139	.098	.085	.544+	.038
	6. Serial Memory (visual)	.144	.217+	.039	.083	.185++	.164++

+ significant at 1% level ++significant at 5% level

This same marked specificity can be seen when inspecting the correlation matrices in Tables VI(A-C), and VII (A-C) in which inter-test correlations are presented by group, and by testing period. Again, only six correlations are above .3, while only one exceeds .4 (when letter recognition and pattern recognition scores and compared during the first testing of Group I (Table VII-A). Thus, most of the qualities evaluated within the total group, and by group, were apparently unique to the tests themselves; and the battery was, overall, measuring highly specific attributes.

Inter-correlations of tests within different testing periods.

In previous studies within this series, the tests administered proved to be highly reliable when evaluated on a test, re-test schedule which sampled behaviors on consecutive days. However, using these same tests and when the same behaviors were sampled approximately 17 weeks apart, as was the case in this investigation, the correlations obtained proved to be quite low and non-predictive. (Table VIII,A-C). The most consistent behaviors sampled, over time, were apparently letter recognition (verbal response), and auditory serial memory. The other behaviors proved highly unstable when a 17 week period separated administrations of tests which purportedly reflected the qualities they represent. Indeed, among all the correlations obtained which might have conceivably reflected intra-test consistency between testing periods, only one exceeded .7 (auditory serial memory between

2nd and 3rd testing (Table VIII-B). In most of the other cases, the intra-test, inter-testing period correlations were .3 or even lower. (Table VIII A-C).

This lack of consistency, of course, could be attributed to several factors: (a) the transitory nature of the qualities tested, (b) the differential effects the enrichment program might have had upon various children in the study, during the periods between testing, (c) the unique effects the regular school program might have had upon improvement recorded upon individual children, and/or (d) poor and inconsistent testing procedures.

Correlations with I.Q. Scores.

When the scores obtained in the six battery tests were contrasted to the I.Q. test administered (SRA's "Short Test of Educational Ability,"Levels 1-2) (Table IX), only low positive correlations were obtained when compared to the test purporting to measure visual serial memory. (Range of r's was .293, to .367). In all other cases the tests within the battery did not correlate meaningfully with the SRA test purporting to evaluate educational ability, and from which an I.Q. measure was obtained.

INTER-GROUP COMPARISONS

The most meaningful data emerging from the study relative to its purposes were scores reflecting various

inter-group differences. While it was pointed out previously that the overall subject population evidenced steady improvement in the qualities measured, most important was to determine the possible effects of the educational enrichment (active games) upon the scores emanating from Group I and from Group II. Important also was to ascertain just when during the school semester significant changes in the behaviors evaluated might have changed significantly, by group. As it was pointed out, Group I received the special enrichment program during the initial part of the school year, (between the 1st and 2nd testings),and then the enrichment program was applied to Group II (between the 2nd and 3rd testing periods).

Thus, Table X contains the mean scores by group and by testing period while these same values are projected again on Figure II(A-F). At the same time, Table XI(A-B) contrasts the improvement, by group, testing period, and by test.

As can be seen in all six tests, during the first 17 week period, Group I, exposed to the special enrichment program during this period, improved more than did Group II, who remained within the regular classroom confines. However, the difference in improvement was statistically significant in only 2 of the 6 tests administered. (Table XI, A). During the second period (following the 2nd testing at which time Group II received special help, their improvement in 3 of the 6 tests administered was significantly greater (at the .01 level)

TABLE IX

CORRELATIONS BETWEEN I.Q. AND SIX SUB-TESTS, BY GROUP AND SEX, AT FIRST TESTING PERIOD

Tests	Total S's (N=157)	All Boys (N=105)	All Girls (N=52)	Group I (N=84)	Group II (N=73)
1. Pattern Recognition	.158	.203	.474	.211	.109
2. Letter Recognition (verbal)	.071	.148	.089	.040	.101
3. Letter Recognition (written)	.135	.186	.001	.168	.082
4. Impulse Control	.148	.151	.140	.080	.246
5. Serial Memory (auditory)	.165	.220	.074	.214	.100
6. Serial Memory (visual)	.314	.293	.367	.309	.307

TABLE X

MEAN SCORES BY GROUP AND BY TEST
AT EACH OF THE THREE TESTING PERIODS

A. Test	FIRST TESTING PERIOD	Group I Mean	Group I S.D.	Group II Mean	Group II S.D.
1.	Pattern Recog.	2.25	1.31	2.15	1.34
2.	Letter Recog. (verbal)	15.54	8.07	14.99	7.88
3.	Letter Recog. (written)	20.02	5.23	20.89	5.30
4.	Impulse Control	29.39	15.58	28.69	14.49
5.	Serial Memory (auditory)	3.08	.84	3.14	.75
6.	Serial Memory (visual)	1.70	.90	1.86	.92

B. Test	SECOND TESTING PERIOD	Group I Mean	Group I S.D.	Group II Mean	Group II S.D.
1.	Pattern Recog.	4.12	.97	2.66	1.27
2.	Letter Recog. (verbal)	23.90	3.19	22.25	4.71
3.	Letter Recog. (written)	24.68	2.12	24.89	1.86
4.	Impulse Control	41.49	24.66	28.43	14.40
5.	Serial Memory (auditory)	3.52	1.07	3.41	.88
6.	Serial Memory (visual)	2.41	1.09	2.38	1.05

C. Test	THIRD TESTING PERIOD	Group I Mean	Group I S.D.	Group II Mean	Group II S.D.
1.	Pattern Recog.	3.75	1.16	3.99	.98
2.	Letter Recog. (verbal)	24.93	2.79	24.93	2.75
3.	Letter Recog. (written)	25.53	.88	25.63	.87
4.	Impulse Control	37.44	18.77	44.96	30.63
5.	Serial Memory (auditory)	3.61	.88	3.51	.82
6.	Serial Memory (visual)	2.07	.99	2.75	1.11

FIGURE II - A. CHANGES OF MEAN SCORES OF PATTERN RECOGNITION

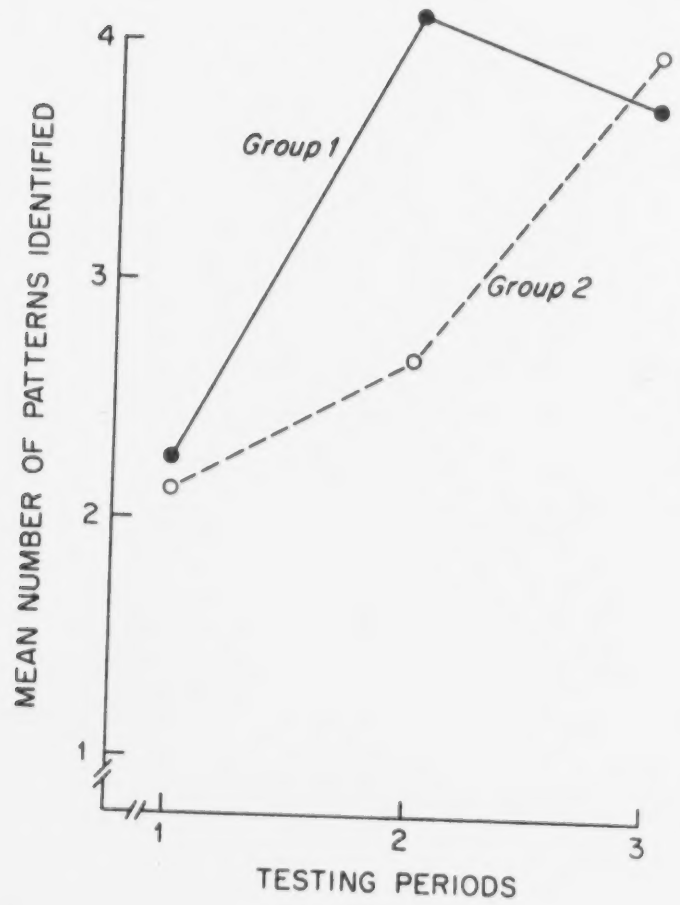

FIGURE II - B. CHANGES OF MEAN SCORES ON LETTER RECOGNITION (VERBAL)

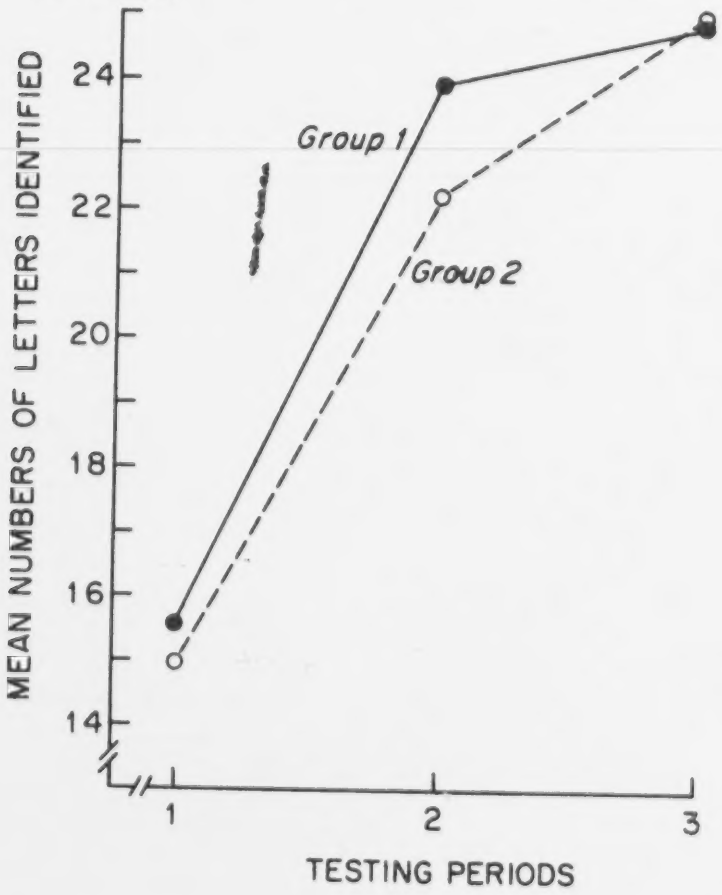

FIGURE II - C. CHANGES OF MEAN SCORES ON LETTER RECOGNITION, (WRITTEN)

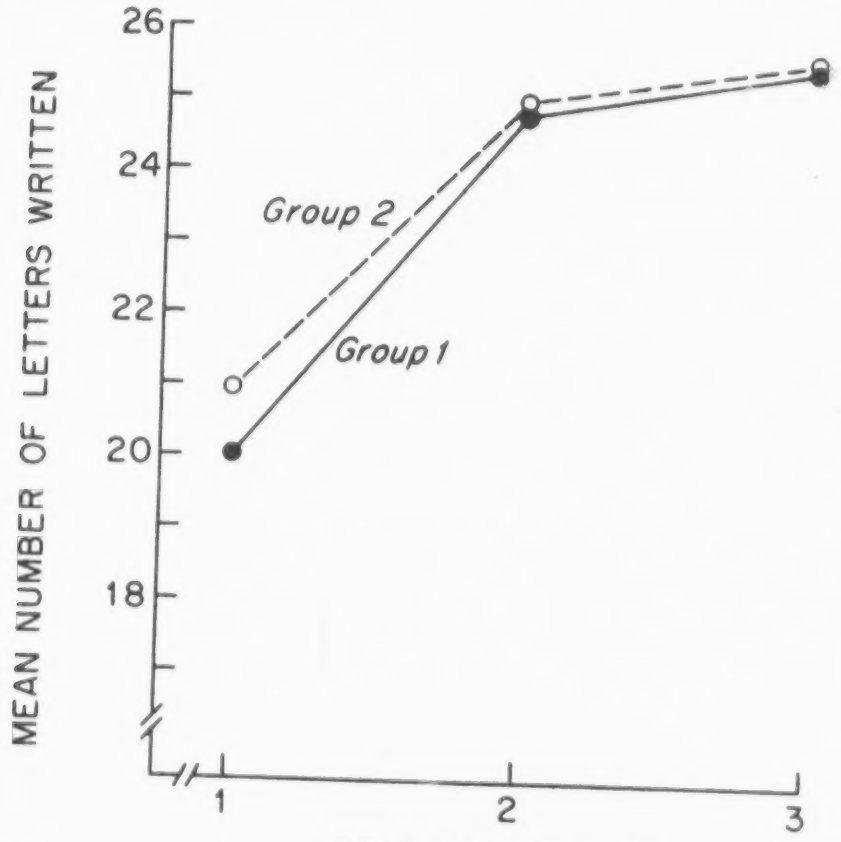

FIGURE II - D. CHANGES OF MEAN SCORES ON IMPULSE CONTROL

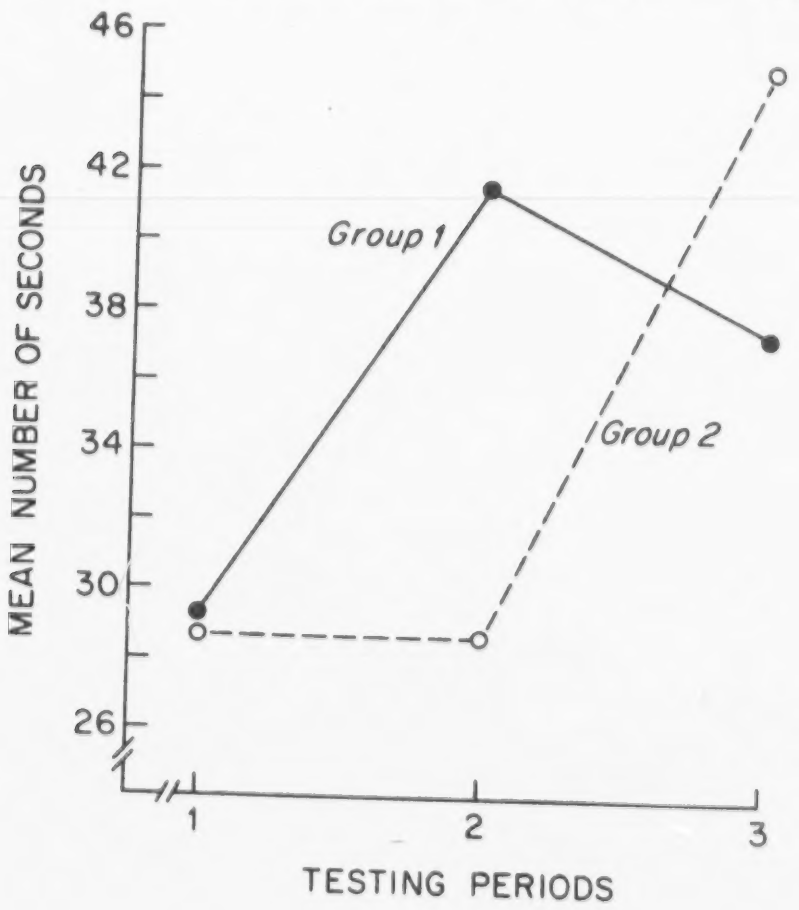

FIGURE II - E. CHANGES OF MEAN SCORES ON SERIAL MEMORY, (AUDITORY)

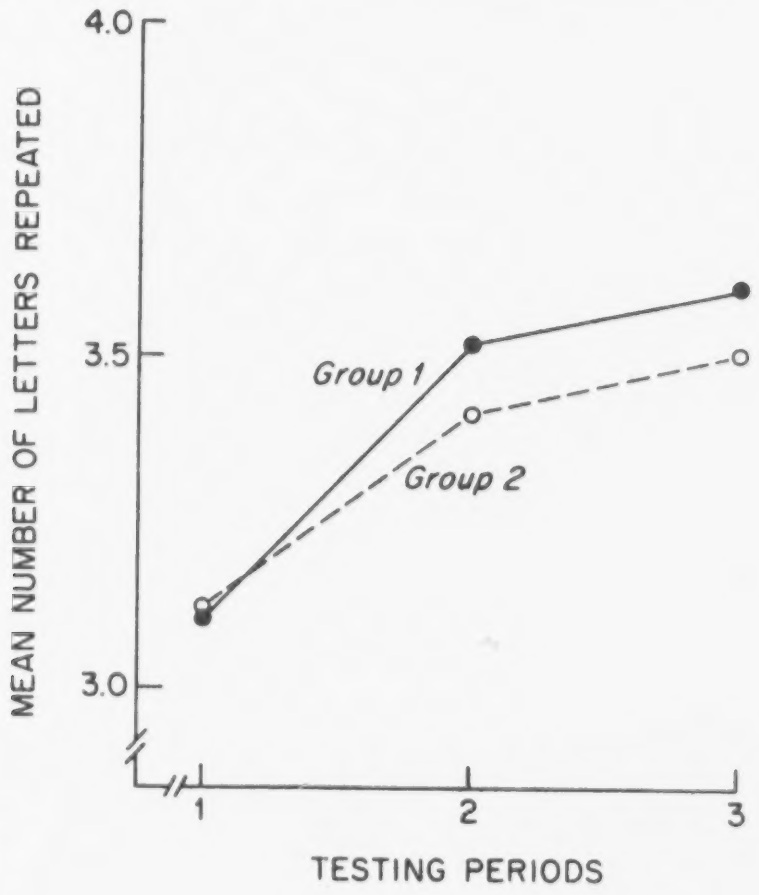

FIGURE II - F. CHANGES OF MEAN SCORES ON SERIAL MEMORY, (VISUAL)

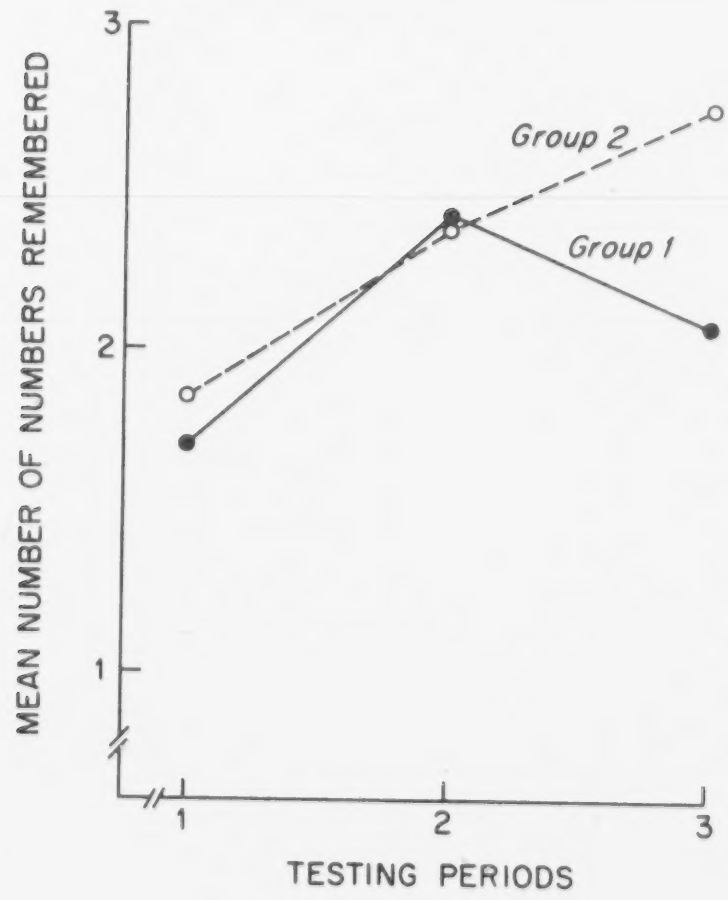

TABLE XI

A. DIFFERENCE OF AVERAGE INCREASE IN THE FIRST SEMESTER

TEST	Mean Increase in the First Semester		Difference	Significance Level
	Group I	Group II		
1. Pattern Recog.	1.87	.51	1.38	.01
2. Letter Recog. (verbal)	8.37	7.28	1.09	-
3. Letter Recog. (written)	4.66	4.00	.66	-
4. Impulse Control	12.10	-.26	12.36	.01
5. Serial Memory (auditory)	.44	.27	.17	-
6. Serial Memory (visual)	.70	.52	.18	-

B. DIFFERENCE OF AVERAGE INCREASE IN THE SECOND SEMESTER

TEST	Mean Increase in the Second Semester		Difference	Significance Level
	Group I	Group II		
1. Pattern Recog.	-.37	1.33	-1.70	.01
2. Letter Recog. (verbal)	1.024	2.685	-1.40	.01
3. Letter Recog. (written)	.857	.740	.12	-
4. Impulse Control	-4.048	16.534	20.58	.01
5. Serial Memory (auditory)	.08	.10	-.02	-
6. Serial Memory (visual)	-.33	.37	-.67	-

than the improvement evidenced by Group I during this same period of time (from the 2nd to the 3rd testing period). (Table XI-B). Moreover, the data revealed lower mean scores achieved by Group I in three of the six tests when the first semester enrichment program was discontinued. There were negative changes in the mean scores when the results of the 2nd and 3rd testing periods were compared in the tests reflecting impulse control, serial memory (visual), and in pattern recognition by Group I. (Table X) The decrease in mean scores reflecting visual serial memory and pattern recognition by Group I, during the period of time their enrichment program was withdrawn, was significant (t's = 2.25, and 2.34 respectively, both significant at the 5% level). The decline in the mean scores for impulse by Group I between the 2nd and 3rd testing periods however was not significant at the 5% level (t = 1.41).

During this same period, however, the mean scores in these same three tests achieved by Group II, who had then been exposed to the enrichment program,evidenced significant gains: i.e., comparisons between the 2nd and 3rd testing periods for the mean scores achieved by Group II, revealed t values of 4.13 for impulse control, 7.82 for pattern recognition, and 2.34 for serial memory (visual), all mean differences are significant at the 5% level, with the first two named significant at the 1% level of confidence.

ANALYSIS OF SELECTED SUB-GROUPS

In order to search the data for additional meaningful information, the scores from three selected sub-groups of subjects were analyzed in some detail. It is often found that the findings from educational studies which have only analyzed large-group data are not made as meaningful as they might be, particularly when a reader either is not sophisticated, and/or one attempts to determine just what an individual "problem child" might accomplish within the program under investigation.

For these reasons the data from children who initially achieved poorly were scrutinized, together with the scores from children whose I.Q.'s placed them within the "retarded" category (between 70-80 or "educables").

Children achieving the lowest scores at the initial testing.

Within both Group I and Group II, the six children scoring lowest on each of the six sub-tests during the initial testing period were inspected in order to determine when and if improvement was apparently forthcoming as in scores achieved by these same children during the 2nd and 3rd testing periods. The results of this analysis follow:

Pattern Recognition:

Initially, six children were found in each of the two groups (total 12) who were unable to identify verbally any of the five geometric patterns which were presented to them.

(Table XII, A). As would be expected, the scores of Group I reflecting the special training improved markedly by the second testing to a mean of 3, while those of Group II did not, mean of 1.33. By the final testing period, after Group II had received special pattern recognition training, their means also reflected a gain about equal to that of Group I, 3.5 as compared to 3.33.

Letter Recognition (verbal response):

As can be seen on Table XII, B, the initial mean scores for the six children scoring poorest in both groups are 1.83 letters of the alphabet identified correctly! By the second testing period, Group I, receiving enrichment, posted a higher mean, 18.5 as compared to 14.33 by Group II, while by the final testing,as was true in the case of pattern recognition, the enrichment program accorded Group II was reflected in a mean increase to 20.66, as compared to 20 letters of the alphabet correctly identified by Group I, at the final testing session. It should be noted, however, that the data revealed that even by the end of the semester, only 3 of these 12 children could correctly identify all the letters of the lower case alphabet verbally when they were presented to them one at a time, visually! One child in Group I, for example, could,by the end of the semester, identify only 7 letters of the alphabet, while a single child in Group II could identify only 6 correctly.

Letter Recognition (written):

This test required the children to print, one at a time, the letters of the alphabet after each had been presented briefly for visual inspection. As can be seen in Table XII, C, again the group means were approximately equal during the initial testing, while by the 2nd testing the mean for Group I exceeded that of Group II, and by the final testing, Group II seems to have "caught up." This type of copying of the letters of the alphabet, involving,in essence, short-term visual memory for letters, seems easier for the children, as by the final testing period only 5 out of the 12 children within this analysis failed to correctly copy all 26 letters of the alphabet, while the lowest score was 21; in contrast to the scores reported previously for reflecting the ability to verbally identify letters.

Impulse Control:

Again the obvious result of special enrichment is apparent in the data reflecting the scores on impulse control. While the poorest mean score was recorded initially by the 6 poorest (fastest) children in Group I, by the 2nd testing the result of the relaxation and impulse control training is apparently reflected in the mean change to 32.33 seconds, as contrasted to the mean at the second testing by Group II, of 28.33 seconds. By the final testing, the mean of Group II has reached 36.83 seconds, while that of Group I actually declined to 23.33 seconds on the line-walking task.

TABLE XII

MEAN SCORES FOR SIX SUBJECTS WITHIN EACH GROUP WHO INITIALLY SCORED LOWEST ON EACH OF THE SIX SUB-TESTS CONTAINED IN THE BATTERY

A. PATTERN RECOGNITION

	1st Testing	2nd Testing	3rd Testing
Group I	0	3	3.33
Group II	0	1.33	3.5

B. LETTER RECOGNITION (VERBAL)

	1st Testing	2nd Testing	3rd Testing
Group I	1.83	18.5	20
Group II	1.83	14.33	20.66

C. LETTER RECOGNITION (WRITTEN)

	1st Testing	2nd Testing	3rd Testing
Group I	7.16	24.33	24.50
Group II	7.33	23.83	24.83

D. IMPULSE CONTROL

	1st Testing	2nd Testing	3rd Testing
Group I	9.5 sec.	32.33 sec.	23.33 sec.
Group II	11.50 sec.	28.33 sec.	36.83 sec.

E. SERIAL MEMORY (AUDITORY)

	1st Testing	2nd Testing	3rd Testing
Group I	1.50	2.5	2.5
Group II	1.66	3.0	3.16

F. SERIAL MEMORY (VISUAL)

	1st Testing	2nd Testing	3rd Testing
Group I	.16	1.83	2.16
Group II	.33	1.33	2.33

Serial Memory:

When items were presented auditorily at the initial testing, the group means were approximately equal (Table XII, E), or 1.5 and 1.66 for Groups I and II respectively. By the second and third trials, the means for Group I remained lower than those for Group II, indicating that for these lowest performing groups, the effects of the training involving the memory and repetition of movement tasks was not reflected in the improvement in the short-term memory of numbers presented auditorily. This general finding is also reflected in the scores obtained from the entire subject populations of the two groups.

Serial Memory (visual):

In the scores reflecting the ability to correctly order pictures presented visually, Group I seemed to improve most initially, and then, as would be expected, the improvement in the means of Group II was apparent at the final testing period. However, it is believed that little of significance can be attached to the slight differences in the mean scores for this sub-test, as shown on Table XII, F.

Summary:

Thus, overall, the most marked changes in sub-test means by children performing poorest initially, occurred in the tests reflecting the verbal identification of letters, impulse control, and the test evaluating the ability to verbally

identify common geometric patterns. Little effects of the special training could be seen in scores reflecting the ability to copy letters in written form, and the two measures of serial memory on the part of children in each group who initially tested lowest.

SCORES OF CHILDREN WITH I.Q.'S OF 80 AND BELOW

Computation of I.Q. scores using the "mental ages" from the SRA's test of "Educational Ability" revealed that 12 children within the total population had I.Q.'s ranging from 72-80, thus placing them within the category of "educable retardate." Eight of these children were in Group I, while the remaining 4 were in Group II, as can be seen when inspecting their mean scores organized by test, by group, and testing period (Table XIII).

Although there is, of course, a significant difference between the I.Q.'s of this group, and that of the total group, 77.17 to 97.36, there are few notable differences between any of the scores collected in the other tests between the total group and those with an I.Q. of from 70-80. Indeed, the low I.Q. group outperformed the group means on several of the tests including the initial and 2nd letter recognition score (written) obtained; as well as the final impulse score collected, 55.36 seconds, as contrasted to only 40.94 seconds on the part of the total subject population.

SUMMARY OF THE FINDINGS

1. The two main sub-groups employed in this investigation were highly similar in make-up, they contained highly similar percentages of boys and girls, and there were no differences in their chronological ages or intelligence quotients.

2. The six tests contained within the battery employed, measured highly specific qualities, evidenced by low inter-test correlations. Similarly, no significant correlations were found between the I.Q. measure obtained and the six tests employed in the battery.

3. The mean scores for each test evidenced regular and significant improvement from the 1st to the 2nd, and from the 2nd to the 3rd testing sessions, when the scores from the total population were computed.

4. Low correlations, while often significant statistically,revealed poor intra-test consistency when the scores obtained from each of the three testing periods were compared.

5. Comparison of mean improvement, by group, revealed that Group I evidenced mean improvement on two of the four tests,which was significantly higher than the improvement seen in the scores by Group II, during the time Group I was receiving special educational enrichment via learning games (from the 1st to the 2nd testing period) and while Group II remained in the regular classroom environment.

TABLE XIII

MEAN SCORES, BY TESTING PERIOD AND BY TEST, OF SUBJECTS SCORING 80 OR BELOW ON I.Q. TEST (N=12); BY GROUP (GROUP I, N=8) (GROUP II, N=4); AND MEAN SCORES FOR TOTAL SUBJECT POPULATION (N=157)

A. TOTAL SUBJECTS (N=157)

	1st Testing		2nd Testing		3rd Testing	
	M	S.D.	M	S.D.	M	S.D.
1. Pattern Recog.	2.20	1.31	3.44	1.33	3.86	1.08
2. Letter Recog. (verbal)	15.27	7.96	23.14	1.33	24.93	2.76
3. Letter Recog. (written)	20.43	5.26	24.78	2.00	25.58	.88
4. Impulse Control	29.06	14.60	35.41	21.50	40.94	25.91
5. Serial Memory (auditory)	3.11	.80	3.47	.98	3.56	.85
6. Serial Memory (visual)	1.78	.91	2.40	1.07	2.39	1.10
7. I.Q.	97.36	10.25				

B. TOTAL SUBJECTS 80 I.Q. AND BELOW (N=12)

	1st Testing		2nd Testing		3rd Testing	
	M	S.D.	M	S.D.	M	S.D.
1. Pattern Recog.	1.91	.99	3.45	1.07	3.54	1.16
2. Letter Recog. (verbal)	18.0	5.53	23.64	2.64	24.36	3.11
3. Letter Recog. (written)	16.73	5.92	24.82	1.26	25.27	1.21
4. Impulse Control	25.36	9.56	38.00	24.23	55.36	41.24
5. Serial Memory (auditory)	2.54	.78	3.0	1.04	3.18	.72
6. Serial Memory (visual)	1.27	.62	2.10	.83	1.82	1.11
7. I.Q.	77.17	2.61				

C. 80 I.Q. AND BELOW, GROUP I (N=8)

	1st Testing		2nd Testing		3rd Testing	
	M	S.D.	M	S.D.	M	S.D.
1. Pattern Recog.	2.16	1.05	3.75	.97	3.25	1.09
2. Letter Recog. (verbal)	19.68	4.65	24.00	2.96	24.13	3.59
3. Letter Recog. (written)	17.75	6.50	24.63	1.41	25.00	1.32
4. Impulse Control	26.00	10.86	50.38	20.78	42.63	22.54
5. Serial Memory (auditory)	2.63	.86	2.88	1.05	3.25	.66
6. Serial Memory (visual)	1.25	.66	2.00	.87	1.38	.99
7. I.Q.	76.75	1.92				

D. 80 I.Q. AND BELOW, GROUP II (N=4)

	1st Testing		2nd Testing		3rd Testing	
	M	S.D.	M	S.D.	M	S.D.
1. Pattern Recog.	1.75	.83	3.00	1.00	4.25	.83
2. Letter Recog. (verbal)	16.25	6.83	23.50	1.66	25.25	.83
3. Letter Recog. (written)	17.00	5.61	25.50	.50	26.00	.00
4. Impulse Control	23.25	3.49	16.25	2.68	74.75	55.76
5. Serial Memory (auditory)	2.50	.50	3.50	.87	3.00	.71
6. Serial Memory (visual)	1.50	.50	1.75	1.09	2.50	.87
7. I.Q.	78.00	3.46				

6. Comparison of mean improvement, by group, also revealed that Group II evidenced more improvement on three out of the six tests employed than did Group I, during the time Group II was accorded special attention in the form of learning games given one-half hour daily (from the 2nd to the 3rd testing period).

7. Thus, during the time a sub-group (Group I and Group II) was exposed to academic enrichment via learning games,significant improvement was recorded in 5 out of the 12 improvement measures obtained.

8. The data revealed that significant improvement in more measures (as contrasted to 2) was recorded during the second half of the school year, as compared to improvement recorded during the first half of the school year.

9. The most marked and consistent improvement was seen in scores reflecting impulse control, the ability to identify geometric patterns verbally, and the ability to verbally identify letters of the alphabet.

10. Inspection of the mean scores of the six subjects in each group who initially scored lowest in each of the sub-tests, also revealed that improvement was seen in the measures obtained during the time each sub-group was exposed to the program of academic enrichment. Again the improvement was most marked in pattern recognition scores, those reflecting the ability to verbally identify letters of the alphabet, as well as in the test reflecting self-control.

11. Analysis of the scores of children who scored 80 and below on the I.Q. test administered, revealed few significant differences in favor of the total subject population. The I.Q. score obtained, similarly, did not correlate significantly with any of the other six measures obtained.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

In the initial portion of this final chapter, the program procedures and findings are summarized, together with the conclusions which seem justified by the data. The final part of the chapter contains a discussion of the implications arising from an inspection of the findings, from consideration of the subjective information obtained, from observing the children, talking to the teachers involved, and consideration of pertinent related literature.

SUMMARY

Introduction:

This monograph represents the third in a series of reports delineating the findings arising from programs for elementary school children in which active games have been employed as a tool for academic enrichment. This initial report detailed the results when a program was applied to a pilot group of 29 children during the 1969-70 school year, in grades 1 through 4 within a "Central City" school in Los Angeles. (8) During the 1970-71 school year, a rather elaborate program was instituted within 16 Central City schools, utilizing 127 children in grades 1 through 4. The children engaged in these previous investigations were selected

because of low scores in tests which purportedly predicted learning potential. The schools in these previous studies, as well as the schools employed in this investigation,were under the jurisdiction of the Catholic Archdiocese of Los Angeles.

The data emerging from these prior programs, when evaluated, suggested that certain academic operations: letter recognition, short-term memory exercises, and the like, would be enhanced when combined with active games. In the 1970-71 study, the design permitted comparision of the effects of learning games with the effects of small-group classroom tutoring. In most cases, exposure to the learning games produced more positive findings than exposing children to traditional classroom tutoring activities, in which the same academic operations were incorporated. (5)

Overview of this Program.

In the program evaluated within the pages of this monograph, 157 first grade children from 17 first grades were employed. One hundred and five (105) were boys, while 52 were girls, and they were selected for the program because of low scores on the Metropolitan Reading Readiness Test, together with observations of low learning potential offered by their teachers. Twelve children were initially

selected from each of the 17 first grades contracted.[4]

Following the administration of a six-category test[5] together with the SRA Educational Ability Test, the children were placed within two groups. Group I, containing 84 children, was exposed during the initial one-half of the school year to one-half hour daily enrichment classes composed of learning games intended to improve the academic operations evaluated by the six-category test battery. Group II, 73 children, remained within their regular classroom environment during the first half of the semester. Following a second testing again using the six-category battery, the children in Group II were exposed to the daily program of learning game enrichment, while Group I remained in their classrooms.

Instructional Program.

The learning games to which the children in Group I were exposed during the first half of the semester, and

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[4]Twenty-seven children of the 204 originally selected were dropped from the study, as their non-attendance or tranfer from the school prevented the completion of the program for which they were selected.

[5]The test evaluated the ability to identify geometric patterns and letters verbally, to write each letter of the alphabet after being shown each, to remember series of letters presented verbally and numbers given visually, as well as a test purportedly evaluating self-control, composed of asking a child to walk as "slowly as you can" along a 12' long line on the floor.

which Group II experienced during the second half of the semester are contained in several publications by the author and by others (3)(4)(6)(8). In general, they are activities which require an active response on the part of the child; he must, for example, run and obtain a large square containing the proper letter, from a group of letters, when a letter is called by the teacher or by another participating child. Large grids containing the letters of the alphabet were employed and children could thus jump in each of the squares, spelling words when asked or merely "jumping through" the letters of the alphabet in order.

During the previous school year, the program was highly structured and standardized; however, during the year covered by this monograph, the content of the enrichment program was unique to each school and flexible. The exact nature of each program was to a large measure determined by regular conferences with each classroom teacher during which time the "enrichment" teacher met with her and discussed the directions of the regular school program and the extent to which the "special children" with whom the "enrichment" teacher was dealing were somehow failing to "measure up." The enrichment program was then geared to meet the needs of the children selected for the special help, and at the same time, the program was continually changed as new problems were noted by both teachers involved.

Several general principles and procedures were followed during the course of the program, with regard to program, instructional objectives, and teaching behaviors.

1. An in-depth month-long teacher education course preceeded the first testing period; during which time the "enrichment" teachers explored games,theoretical underpinnings of an active approach to learning, and learned how to administer the tests to be given.

2. Regular weekly conferences were held between the program administrators and the enrichment teachers, during which time program content, administrative problems, and individual children's needs were discussed. Monthly conferences were held between the "enrichment teachers" and the regular classroom teacher during which similar subjects were brought up. Often these latter conferences were also attended by a member of the staff administrating the project.

3. During the time lessons were given, emphasis was placed upon good listening skills, understanding directions, and gaining better self-control. This latter goal was reached by inserting specific activities involving relaxation training and the like into the program on a regular basis, directed toward the children evidencing a need for this type of help.

4. In order to introduce a measure of objectivity into the procedures, the "enrichment" teachers did not test the

children whom they taught on a daily basis.

5. Although the teachers were made aware of the scores achieved by the children with whom they were dealing, they were urged not to "teach toward the tests." For example, "slow line walking" was not employed as an exercise in impulse control, even though other typs of slow-down activities were, i.e., "How slowly can you stand up with a bean bag on your head?" or "how slowly can you draw a line down the blackboard?", etc. At the same time, a variety of letter recognition games were employed, rather than ones which specifically resembled those on the test battery, while serial memory games involved attempting to remember and to replicate a series of movements, rather than activities specifically designed along the lines of the two tests of serial memory contained in the battery.[6]

6. In all cases possible,transfer to various academic operations was taught for, rather than left to chance. For example, lessons invariably included a blackboard as an important piece of equipment. Thus, as children jumped in letters, or found geometric figures on the ground, they

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[6]However, it was noted that relatively little time was spent by teachers on serial memory games, rather they cleaved more toward remediating deficiencies in letter recognition, phonics problems, and the like, perhaps encouraged by the regular classroom teachers to concentrate upon these obvious learning deficiencies. This observation will be commented upon further in a section which follows.

were often asked to write the letters, words, or geometric figures on the adjacent blackboard. In previous studies, as might be expected, little improvement was seen in the ability to write letters and words, if these opportunities were not "built-in" the lessons to which the children were exposed.

Findings:

Analysis of the data, involving intra-group correlation of the test scores, inter-group comparisions of rates of change and similar procedures, produced the following findings:

1. Significant improvement was recorded, by both Group I and II, on 5 out of the 12 measures obtained which would reflect change, during the time of the school year the "enrichment program" would be expected to elicit change in the behaviors measured. That is, in 2 out of the 6 measures reflecting possible change in Group I, during the first half of the semester, significant improvement was recorded over and above that found in the scores elicited from Group II during the same period. Conversely, significant improvement in 3 out of the 6 tests was seen when the mean scores of Group II were contrasted (2nd to 3rd testing period) during the second half of the semester when they were exposed to the enrichment program, as contrasted to the same

mean scores elicited from Group I during this same period of time.

2. This same trend, throughout the year, was noted in selected tests when the scores for children initially performing lowest (6 children from each group) in each of the tests administered.

3. The most marked improvement was seen on tests reflecting the ability to exercise self-control, and those assessing the ability to identify verbally selected geometric patterns, and the ability to name the letters of the alphabet when inspected visually. Little improvement was seen in the tests of serial memory ability administered three times during the school year.

4. Few meaningful and significant correlations were found when test scores were contrasted at each testing period (using the total subject population and by sub-group).

5. No significant correlations were found when I.Q. was compared to the other test scores obtained; and similarly when the scores of children scoring between 70 and 80 in the I.Q. test were inspected and compared to those achieved by the total population during the school year, few meaningful differences were noted.

Conclusion:

Thus, based upon the inspection of these findings, it was concluded that the program of "active game enrichment"

had a significant positive effect on selected measures of academic achievement.

Interpretation of the Findings:

Several cautions should be inserted at this point, as the reader attempts to interpret the validity and implications arising from the findings. For example, the lack of sufficient control groups (at least two more additional were needed) renders it difficult, if not impossible to separate the effects of the "active academic enrichment" from the effects of the special attention accorded a select group of children during the school year. It was noted, for example, that leaving the regular classroom seemed highly prized by the children remaining, as well as by those who received the opportunity for this kind of special help.

It has long been noted in studies in which human subjects (particularly impressionable children) have been employed as subjects, that the experimenter effects can be considerable, and indeed often override the effects of the critical variables studied.

At the same time, within a regular school classroom, one cannot separate the effects of teacher attention, feelings, and personality, from the content she is "sending" out to her charges. Thus, the study described on these pages more closely parallels the "real" educational world, and as a result, perhaps the findings and conclusion can be more

easily interpreted by educators inspecting these pages; while remaining abhorrent to the strict behavioral scientist undertaking a similar perusal.[7]

IMPLICATIONS

A number of types of implications and interpretations may be derived from any type of study carried out; implications for the improvement of experimental methodologies, for further studies of a similar nature, for the enrichment of educational programs, as well as theoretical speculations which are suggested by the findings and conclusions. From the theoretical standpoint, for example, some of the data was supportive of the supposition that the insertion of academic content into movement experiences does indeed improve academic learning. Thus, to further explore this theoretical pathway, further studies could contain movement problems of a broader scope; problems which would encourage children to exhibit a variety of intellectual behaviors (problem solving, evaluation, categorization, memorization, etc.) (9).

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[7]The critical reader might be more heartened and derive more security from the inspection of the previous study in this series in which small-group classroom controls, as well as control groups doing nothing, and participating in regular physical education programs were employed. (5)

The data also suggested that the effects of the active game approach to academic improvement had highly individual effects upon the participants. Individual differences in the ability to learn, as well as the susceptibility to various educational strategies have long been written about within educational journals, and during recent years these differences have been the subject of numerous well-controlled studies (11). Further studies in this series will also explore the influence of selected individual differences in perceptual and cognitive styles, as well as sex, ethnic background and age differences upon the influences of an active approach to academic improvement.

Also interesting was the lack of meaningful correlations between the I.Q. test scores obtained and the sub-tests within the battery. As there is impressive evidence that the ability to name and enumerate letters of the alphabet and geometric figures is predictive of and contributes to later success in reading (2), a more thorough inspection of the I.Q. test content might be in order.

The SRA test was recommended as a non-verbal test of intelligence whose results would therefore be relatively uncontaminated by the sub-culture in which it is administered. However, inspection of the test's content reveals that the sub-sections contain items which seem indeed closely related to the extent to which a child's environment is laden with

a variety of objects, "things," and events. For example, one section contains a series of pictures to which a child must ascribe causality; while a second section asks a child to attach verbal meaning to a wide variety of objects and people and happenings. A third section contains problems which evaluate what is termed "spatial relations," a quality which has traditionally been found in tests purportedly evaluating perceptual maturity and similar qualities but which also often reveals low correlations with tests of reading ability and later reading success.[8]

Although the finding that improvement in serial memory scores was not forthcoming upon purportedly exposing children to serial memory tasks involving the replication of movement series, it is perhaps explicable with reference to two probable causes. (a) The measures of serial memory employed were indeed specific to themselves, and unrelated to the content of the training tasks, or perhaps more likely

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[8]Indeed it is usually found that the degree to which a test is predictive of a given type of academic operation, is dependent upon the extent to which the test items resemble the academic task it is hoped to predict. Thus, it is unlikely that one would find that various non-verbal measures, as contained on the SRA, are predictive of items which are laden with verbal content, such as the letter recognition and pattern recognition sub-tests contained in the battery employed in this study. Similarly, it is often found, for example, that as one increases the similarity between the predictive test (moving from pattern recognition, to the de-coding of letter-combination sounds) one is likely to arrive at a test which has an ever higher correlation with future reading ability. (1)(2)(9)

(b) The "enrichment teachers," heeded the classroom teachers' admonishments to concentrate upon tasks resembling classroom exercises, i.e., letter identification and the like, and thus avoided extensive use of the serial memory games which were contained in the teacher preparation program to which the former were exposed. Indeed, questioning to determine the enrichment teachers' actual program content at the completion of the school year, plus frequent inspections of the nature of that content during the same time period, tended to confirm the latter speculation. (b) Thus, the possible transfer from the remembering of a series of movements to short-term memory tasks involving other stimuli (i.e., letters and numbers given verbally and visually) as seemed to occur in the previous study within this series (5), was not reflected in the data obtained following the current program evaluated.

A number of positive outcomes of the study were not amenable to statistical objectification. The positive responses of the classroom teachers were uniformly positive and supportive. Almost without exception they perceived positive changes in the attitudes and abilities of the children who were exposed to the special enrichment.

Additionally, the "active enrichment" contained components which were not measured, but with the insertion of additional tests, could have been assessed. The letter

recognition games were invariably accompanied by phonics training. For example, sounds were emitted by the "enrichment teachers" and children had to find the corresponding letter, or upon finding a letter or letter combination, a child had to emit the sound(s). At other times, children were required to jump upon a letter or letter combination which represented the initial, or terminal sounds within a word which was written or spoken aloud by the teacher. Listening skills were also emphasized by many of the teachers; skills which were not measured directly within the tests given in the battery employed.

The data also revealed that upon termination of a program of the type studied, there may be regressive effects on the part of the participating children. Several declines in mean scores, by children in Group I were noted when the program was discontinued during the second half of the school year, and when the final tests were administered at the final part of the year. The most pronounced drops occurred in the tests evaluating self-control and pattern recognition, while slight decreases were noted in the tests of letter identification despite the fact that the children in this first group, of course, continued to be exposed to regular classroom experiences during the second half of the school year. It is apparent upon observing many of these children, and upon inspecting the data obtained that

there are children within each classroom who will achieve to their optimum only if given special attention in small groups, or on an individual basis.

EPILOGUE

Within the previous pages it has been attempted to evaluate the results of a program of active learning games upon selected abilities of first grade children evidencing low potential for acquiring academic skills. The discourse has some obvious scientific deficiencies, many of which have been pointed out, at the same time, the data contained in this monograph and within others in this series has correctly prompted numerous school districts to implement their regular programs of education with experiences in which children are encouraged to exercise their movement capacities and thus fulfill their activity needs while acquiring imperative academic operations. These data and data obtained previously, while not startling, are highly encouraging.

The apparent reasons that an "active approach" seems to work well with many children, as has been pointed out, include the suggestion that games are motivating, they aid in fulfilling and meeting the activity needs of many children, and they seem to require and elicit the total attention of the children participating. Furthermore, when a child is placed in action and encouraged to act in rather obvious

ways while he plans, thinks, and manipulates symbolic and quantitative information, the quality of his efforts is easily observed and evaluated by the instructor.

It is hoped that in further work, we will be able to continue to explore the effects of this movement approach in improving the abilities of young children engaged in quantitative thought and mathematical operations. It is further desired that the information contained on the previous pages may inspire educators to explore this potentially useful learning modality, while encouraging the educational researcher to further elaborate upon some of the hypotheses only briefly sketched on these pages.

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APPENDIX

EQUIPMENT

Equipment was either constructed for the project or was purchased from the following suppliers:

1. Large plastic squares containing upper and lower case letters were obtained from Action Learning, Inc., P.O. Box 49672, Los Angeles, California 90049.

2. Lining tape may be obtained from hardware stores and is Scotch Tape #471. This was used to make large geometric figures.

3. Science Research Associates catalogue and tests were obtained from 259 East Erie Street, Chicago, Illinois, 60611.

4. Primary Reading Cards were obtained from Educational Card Company, 1640 N. Stanley Avenue, Los Angeles, California.

5. Alphabet Flash Cards were obtained from Kenworthy Educational Service, Inc., 138 Allen Street, Buffalo, New York.

6. Sound Flash Cards were obtained from Open Court Correlated Language Arts Program, Open Court Publishing Co., LaSalle, Illinois, 61301.

CENTRAL CITY TUTORING PROGRAM TEST BATTERY

NAME _____ DATE _____

I. Pattern Recognition

Verbal Equipment: Five flash cards with geometric figures: circle, square, rectangle, triangle, and half-circle; a table and two chairs.

Procedure: Place the squares on a table at which the tester and the child are seated. Hold up one learning square at a time and allow 3 seconds for the child to tell the name of the design. Record 1 point for correct response.

Square
Circle
Rectangle
Triangle
Half-Circle
Total Right

II. Letter Recognition

A. Verbal Response:

Equipment: One complete alphabet of upper case letters. A table and two chairs.

Procedure: Have the child seated across the table from the tester so that the letter on the flash card will be clearly visible to the child. The card should be tilted at a 45 degree

Letter Recognition (Verbal Response) cont.

angle to prevent glare. Arrange and present the letters as they appear on the test for 3 seconds each. Turn the card face down, child responds verbally. Record the incorrect responses with a / through the letter.

	Test Items	Score-No. Right
Verbal	H P A V E Z L C J S X M G B Q Y T O D K W N R I F U	

B. Written Response

Equipment: One complete alphabet of lower case letters. A table and two chairs. A sheet of primary writing paper and a pencil.

Procedure: Seat the child across the table from the tester. Give him a pencil and a sheet of paper. Say, "I will show you a letter. I want you to say the letter and then write it after I put the card down." Allow a five-second interval. Record with a / through the letter.

Written	n c x j f r z a l p u y h m b w q i e o v t d k s g

III. Impulse Control

Equipment: With Yellow Marking Tape make a 12 foot line. A stopwatch.

Procedure: Have the child stand at one end of the line. The tester demonstrates to the child how and where he is to walk. Say: I would like to see how slowly you can walk to the end of the line. You may not stop moving, and try not to step off the line. Score number of seconds it takes the child to walk to the end of the line. Time the child when he begins walking the line and stop the watch when child has his last foot at the end of the line.

seconds

IV. Serial Memory

A. Auditory Memory

Equipment: Table and two chairs

Preparation: Child is seated across the table from the tester.

Testing: "I will say some letters. Listen carefully. After I have finished, say the letters the same way I said them to you." Score one point for each complete correct verbal set. Do not say letters in rhythmic style; say them at the rate of 1 per second.

F
C L
N W T
D R B Q
I S M Y A
E K O H J G
P X R U H Z V
O S T B N Q H G

_____
_____
_____
_____
_____
_____
_____
_____
_____

Total Score ☐

B. Visual Memory

Equipment: Set of Alphabet Flash Crads. A table and two chairs.

Procedure: Child is seated across the table from tester.

Testing: "I will put some letters on the table. Then I will mix them up and give them to you. Put them on the table the same way I did." (Since tester is facing the child, be sure the cards are set down so the child can see them in the right position). Score one point for each set done correctly. Expose letters for a time limit of up to 20 seconds.

J D
E P T
G Q M F
O L H B I
C X A Y N Z
S W K U L V R

_____
_____
_____
_____
_____
_____
_____

Total Right ☐